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Opinion Paragraph Writing Intervention for Students with Significant Disability

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Abstract

Increasingly, technology has been used to provide access to academic curricula for students with moderate to severe intellectual disability. In the current pilot study, we used a multiple probe across participants design to evaluate the effectiveness of a technology-based instructional package on the opinion writing skills of three middle school students with moderate and severe intellectual disability. Findings suggest that the intervention resulted in improved performance across all three participants and that all participants maintained performance at levels greater than baseline. Limitations and implications for practice and future research are discussed.

Keywords: writing intervention, assistive technology, autism, intellectual disability

Introduction

A recent shift in the focus of instruction for students with moderate to severe intellectual disability has afforded new opportunities for participation in the

general education curriculum. This change, precipitated by legislative calls for accountability (e.g., No Child Left Behind [NCLB], 2002; Individuals with Disabilities Education Improvement Act [IDEA], 2004) and the promise of an emerging body of research on the effectiveness of academic intervention for students with moderate and severe intellectual disability (e.g., Hudson, Browder, & Wood, 2013; Spooner, Knight, Browder, & Smith, 2012), necessitates that educators reconsider curricula for this unique population. That is, they must expand upon a well-established concept of functional curriculum (Brown et al., 1979) and adopt new expectations related to performance in academic contexts.

This expanded vision for educating students with moderate and severe intellectual disability includes the expectation that all students make progress in the general education curriculum and work toward achieving college readiness skills. Central to these aims is the delivery of high quality instruction in the area of literacy so that students can more effectively acquire and demonstrate their understanding of content knowledge through reading, writing,

speaking, and listening (Kearns et al., 2010). Unfortunately, the majority of research on literacy instruction for students with moderate and severe intellectual disability has focused narrowly on reading sight words (Katims, 2000). Only recently have researchers turned their attention to other skills that are targeted during literacy instruction for students with moderate and severe intellectual disability. Several research teams have looked to the English Language Arts (ELA) benchmarks, as defined in the Common Core State Standards, for guidance (Conley, 2007; Kearns et al., 2010; Spooner & Browder, 2015) and have designed effective interventions for teaching a range of skills (e.g., Hudson et al., 2013; Hudson, Browder, & Jimenez, 2014; Mims, Hudson, & Browder, 2012). These important advances in the technology of teaching for students with moderate and severe intellectual disability further support the need for an increased research emphasis on intervention for this critical set of skills.

Despite the emergence of sound methods for the instruction of students with moderate and severe intellectual disability in reading, there has been little work in the area of written expression (Pennington & Delano, 2014). Written expression plays a critical role in the lives of all students as it serves a range of functions in educational settings. Students use writing to demonstrate their understanding of content across academic areas, to share their ideas about the world, and to engage in social interactions with peers. Furthermore, writing skills are essential to college and career readiness as they are necessary for success across a range of tasks in postsecondary environments. Unfortunately, data suggest that many students with and without moderate and severe intellectual disability have difficulty acquiring proficiency in written expression (U.S. Department of Education, 2011). Written expression is complex and involves the simultaneous execution of a constellation of skills to generate a specific message for a particular audience. This task is often more difficult for students with moderate and severe intellectual disability as they may present deficits in social

communication, fine motor skills, reading comprehension, and perspective-taking.

Few research teams have investigated strategies for teaching writing to students with moderate and severe intellectual disability. Two reviews of the research literature on writing interventions for students with intellectual disability (Joseph & Konrad, 2009) and autism spectrum disorder (Pennington & Delano, 2012) indicated that the majority of investigations were applied to spelling and word construction tasks, but few involved the production of written narratives. The authors also noted that explicit instruction, assistive technology, and predictable writing routines were consistently applied as an intervention component. More recently, research teams have applied variations of these components to a range of writing skills including spelling (Purrazzella & Mechling, 2013), story writing (Pennington, Ault, Schuster, & Sanders, 2011; Pennington, Collins, Stenhoff, Turner, & Gunselman, 2014), using personal narratives within text messages (Pennington, Saadatzi, Welch, & Scott, 2014), and writing resume cover letters (Pennington, Delano, & Scott, 2014). Across these studies, researchers consistently applied response prompts (i.e., simultaneous prompting, system of least prompts, time delay) but employed disparate forms of technology (i.e., robot technology, commercial writing software, tablet personal computers).

The frequent application of technology-aided instruction (TAI) during writing intervention for students with moderate and severe intellectual disability is not surprising as it offers several advantages to the emerging writer. First, writers may use software that allows for the construction of written products in the absence of a spelling repertoire (Pennington, 2016). For example, students may select a word from a software array to complete a sentence about a picture, or select multiple words to construct a sentence about what they read. Second, the digital presentation of instructional stimuli about which the student is expected to write may be designed in such a way

that relevant stimuli might be highlighted or repeated. This increased salience of instructional stimuli may facilitate student attention and stimulus control. Finally, some students' preferences for particular features of the technology may serve to reinforce their writing behavior (Pennington, 2010). Data suggest that some students prefer TAI in lieu of traditional teacher-delivered intervention (Moore & Calvert, 2000). In light of these advantages, future research in writing and moderate and severe intellectual disability will likely include innovations steeped in TAI.

The current literature on teaching writing to students with moderate and severe intellectual disability is promising and suggests a path forward (i.e., explicit instruction, technology) in developing more complex literacy repertoires for this population of students. Interestingly, the guidance offered by the literature reflects practice inconsistent with established guidelines for teaching writing; that is, the majority of research teams have focused on writing without consideration of ongoing reading instruction. Written expression plays a critical role in reading comprehension. When students are asked to write in the context of academic instruction, they are provided with opportunities to make decisions about and therefore, reexamine the content (Graham & Harris, 2016). In the current study, we sought to investigate the effectiveness of a technology-based instructional package on the opinion writing skills of three middle school students with moderate and severe intellectual disability. The package included the digital presentation of grade-aligned text and subsequent instruction on writing an opinion about the text. We addressed the following research questions: (1) Is there a functional relation between the use of a technology-aided intervention package and the percent of correct steps performed during students' opinion writing tasks? and (2) What is the effect of a technology-based, task-analyzed writing intervention on the social validity as reported by the teacher?

Target Audience and Relevance

In light of a limited body of research to guide practitioners in teaching writing to students with developmental disabilities, this paper demonstrates an effective application of assistive technology (AT) within the writing process for students across grades 5 to 8. This paper may serve as a starting point for a range of practitioners (e.g., general and special education teachers, speech-language pathologists, assistive technology specialists) working with students with developmental disabilities in designing rich, grade-aligned ELA instruction that addresses skills in both reading and written expression.

Method

Participants and Settings

Three participants, ages 10 to 14 years, with moderate and severe intellectual disability participated in the study. All three students received special education services in a middle grades self-contained classroom (5th grade through 8th grade). ELA instruction in the classroom, at the time of the study, focused on early literacy or early reading skill building using elementary aged books. Little to no grade-aligned ELA instruction occurred in the classroom. The participants met the following inclusion criteria: (a) educational eligibility for autism and/or an intellectual disability, (b) use of the select and drag feature on an iPad, (c) participation in state alternate assessment based on alternate achievement standards, (d) regular school attendance, and (e) visual and auditory acuity. All three participants had previous experience using an iPad in educational settings. Students selected their own pseudonyms.

Frodo was a 10-year-old Caucasian female in the 5th grade. Frodo was identified as having a moderate intellectual disability. Frodo used a combination of spoken words and picture symbols to make requests and had little to no exposure to grade-aligned text or grade-aligned ELA instruction (See Table 1).

Jay was a 14-year-old Caucasian male in the 6th

Table 1
Participant Demographics

Student/ Gender/Ethnicity	Age/Grade	IQ Test Given/ IQ	Disability	Reading/ Vocal Verbal Ability
Frodo/ Female/ Caucasian	10/5th	WISC-IV/50	Significant Intellectual Disability	Non-Reader/ Vocal Verbal
Jay/ Male/ Caucasian	14/6th	WISC-IV/<50	Significant Intellectual Disability	Non-Reader/ Vocal Verbal
Shrek/ Male/ Caucasian	14/8th	WISC/<40	Significant Intellectual Disability	Non-Reader/ Vocal Verbal

grade. Jay was identified as having a moderate intellectual disability and primarily used picture symbols to communicate. Jay had little to no exposure to grade-aligned text or grade-aligned ELA instruction (See Table 1).

Shrek was a 14-year-old Caucasian male in the 8th grade. Shrek also was identified as having a significant intellectual disability and used picture symbols to communicate. Shrek had little to no exposure to grade-aligned text or ELA instruction (See Table 1).

The interventionist was a graduate research assistant with five years of experience in working with students with multiple disabilities and behavior concerns. The interventionist and a graduate assistant (i.e., doctoral student in early childhood education), who conducted inter-observer reliability and procedural fidelity checks, were trained to conduct baseline and intervention procedures.

The researchers conducted the study in a rural public middle school in the southeastern United

States. Sessions were conducted at least three times a week for five weeks of intervention. Sessions occurred in a room attached to the student's regular classroom. Each session lasted approximately 40 minutes.

Materials

Adapted story. An adapted version of *Outsiders* was read aloud via a standalone iPad app, *Access: Language Arts* (Attainment Company, 2016) with professional narration (a professionally recorded voice, as opposed to a text-to-speech 'robotic' voice). The adapted version of *Outsiders* was rewritten at 3.5 grade level, divided into five chapter pairings with reduced text and picture supports. Each chapter pairing contained two chapters (i.e., 1 and 2, 3 and 4, etc.) and ranged from 11-14 pages in length. Picture supports were used for key vocabulary words, primarily nouns and verbs, and characters. Each page held approximately 42 words and 10 picture supports, along with underlined vocabulary words. Each page was read aloud, via the app, and at the end of each page the student pushed the

arrow to proceed to the next page. Students also were able to press the underlined vocabulary for definitions. Each chapter pairing took approximately 20 to 25 minutes to read.

iPad app. *GoBook* app (Attainment, 2015) was used to develop a writing intervention to accompany the *Outsiders* story. The *GoBook* app presented vocabulary words (e.g., brother, group), instructional words (e.g., setting, main character, conclusion), and an overview of the types of sentences required for writing a paragraph (i.e., introduction, opinion, fact, conclusion). The *GoBook* app used text-to-speech for the writing instruction and intervention, as opposed to a human recorded voice as was used in the adapted story.

Writing intervention. During the writing activity, *GoBook* presented a display with a statement and three options from which students made a selection by touching the choice on the iPad screen. We designed displays for the selection of identifying: (a) a writing topic, (b) an opinion on the chosen topic, (c) a fact that supported the identified opinion, (d) a second fact that supported the identified opinion, (e) a conclusion statement, and (f) an opportunity to change opinions. In addition, pages were created to address error corrections, as needed, and pages were created that allowed the students an opportunity to write their chosen responses by completing sentences through the use of drag and drop. More specifically, when presented with a screen with the question, “What will you write about?” three choices were presented including one distractor (i.e., a character, a big idea, or a random topic not related to the story). After choosing a subject to write about, the next display asked about which specific story topic the participant wanted to write. For example, “Who do you want to write about? Cherry, Pony-boy, or Michelle Obama.” Again, two correct answers and one far distractor were presented. Next, the student established an opinion about the topic selected. The next two displays were designed to identify the facts that backed up the student’s opinion. The display screen asked, “Which fact supports your opinion?”

followed by a writing prompt that filled in the student’s opinion from the prior page (e.g., I think Pony-boy is nice because _____”). This prompt was followed by three response options including the correct answer, a response containing a fact that supported the opposite opinion, and a response that did not occur in the story. If the students chose the opposing response option, then they were directed to a page that provided them an opportunity to change their opinion or change their fact choice. Lastly, on the conclusion display, the screen asked, “What is the last sentence you want to write about?” A conclusion statement for the answer was given, (i.e., “In conclusion, I think Pony-boy is nice because...”) along with three choices.

Each display page had picture supports next to the choices and picture supports for key words such as sentence type and characters. If the student selected distractors, *GoBook* implemented error correction procedures, first informing the user that the selection was incorrect, then eliminating (graying out) the option. In addition, the fact question included a hint button located at the bottom of the screen. When students used this button, the screen went to the page of the story where the answer was located. The interventionist read this page aloud to the student, then went back to the fact question. Interactive drag and drop screens were placed in between each display question page, where students were to touch and move the sentences into the paragraph. After the interactive page came a completed paragraph with a task analysis chart showing sentence number and sentence type with check marks to indicate completion. The writing intervention took approximately 10 to 15 minutes to complete. See Table 2 for an overview of the intervention.

Research Design

To pilot test and evaluate the efficacy of the writing intervention, the researchers used a preliminary concurrent multiple probe across participants single subject design (Horner & Baer, 1978). Baseline data

Table 2.1
Writing Intervention

Pre-Writing Activity Steps	Display Screen	Practice Utilized
App reads story aloud to student, while student pushes arrow to advance pages	Chapter pairing of <i>Outsiders</i> adapted story	Read aloud
Paragraph vocabulary and instructional vocabulary	Four (4) vocabulary words students will see for choices (e.g. excited, horrible, disappointed, and unlucky) Introduction, Opinion, Fact and Conclusion	Read aloud Model, Lead, Test (My turn, our turn, your turn) Student has read aloud
Paragraph structure	Introduction, Opinion, Fact, Supporting Fact, and Conclusion with Definitions	Read aloud
Writing Activity Steps	Display Screen	Practice Utilized
Introduction instruction	The introduction is the first sentence in your paragraph. In the introduction you tell who, or what, we are writing about.	Read aloud Interventionist asks, "What is the first sentence?"
Introduction writing	What will you write about? A character and setting, a big idea, or a bird?	Time delay of 5s, error correction, least intrusive prompts
Introduction writing	Who/What do you want to write about? Ponyboy, Cherry, or George Washington?	Time delay of 5s, error correction
Drag and drop introduction blank	In this chapter, _____ is a main character.	Drag and drop with least intrusive prompts, time delay of 5s, read aloud sentence for review
Opinion instruction	In your second sentence, you will write your opinion. An opinion is a viewpoint. You share your thoughts, feelings, or beliefs about something or someone from the story.	Read aloud. Interventionist asks, "What is the second sentence?"
Opinion writing	What is your opinion of Ponyboy? I think Ponyboy is _____. Nice, trouble, or scientific	Time delay of 5s, error correction, least intrusive prompts
Drag and drop introduction and opinion sentences	Drag your introduction and opinion sentences into the box to start constructing your paragraph	Drag and drop with least intrusive prompts, time delay of 5s, read aloud sentence for review

Table 2.2
Writing Intervention

Writing Activity Steps	Display Screen	Practice Utilized
Sentence chart review	Now you have your first two sentences. Let's read your paragraph so far: In this chapter, Ponyboy is nice. I think he is nice because he looks out for his friends. Another reason...	Read aloud and review. Completed sentences and sentence types
Fact instruction	Next, you need to support your opinion with a fact from the story. A fact is a detail of piece of information found in the story.	Read aloud. Interventionist asks, "What is the third sentence?"
Fact writing	I think Ponyboy is nice because _____. He looks out for his friends, he snuck into the theater without paying, he likes to bake cakes.	Time delay of 5s, error correction, least intrusive prompts
Change opinion (only is wrong choice of opinion)	Sneaking in the theater without paying is <u>not</u> nice. Do you want to change your opinion of Ponyboy from "Ponyboy is nice" to "Ponyboy is trouble"? Yes, I have changed my mind or No, I want to change my fact.	Student chooses. If selection to change opinion, go back to "What is your opinion of ____?" and repeat remaining options (only one time). If selects "No," allow to continue with writing paragraph.
Drag and drop fact sentence	Drag your fact sentence into the box to start constructing your paragraph.	Drag and drop with least intrusive prompts, time delay of 5s, read aloud sentence for review
Sentence chart review	Now you have your first three sentences. Let's read your paragraph so far: In this chapter, Ponyboy is a main character. I think Ponyboy is nice. I think he is nice because he looks out for his friends. Another reason...	Read aloud and review completed sentences and sentence types
Fact instruction	Remember, a fact is a detail, or piece of information from the story that supports your opinion. You wrote Ponyboy is nice. You need to find another fact to support your opinion.	Read aloud. Interventionist asks, "What sentence is next?"

Table 2.3
Writing Intervention

Writing Activity Steps	Display Screen	Practice Utilized
Fact writing	Choose another fact that supports your opinion that Ponyboy is nice. Another reason I think Ponyboy is nice is because _____. He made friends with the girls, he stayed out late, he has a bicycle	Time delay of 5 s, error correction, least intrusive prompts
Drag and drop fact sentence	Drag your fact sentence into the box to start constructing your paragraph.	Drag and drop with least intrusive prompts, time delay of 5 s, read aloud sentence for review
Sentence chart review	Now you have your first four sentences. Let's read your paragraph so far: In this chapter, Ponyboy is a main character. I think Ponyboy is nice. I think he is nice because he looks out for his friends. Another reason I think Ponyboy is nice is that he made friends with the girls.	Read aloud and review completed sentences and sentence types.
Conclusion instruction	The final step is to write the conclusion. The conclusion is where you summarize your paragraph.	Read aloud. Interventionist asks, "What is the last sentence?"
Conclusion writing	What is the last sentence you want to write about Ponyboy? I think it is good that _____. Ponyboy is nice, Johnny is Ponyboy's friend, Ponyboy likes monkeys	Time delay of 5 s, error correction, least intrusive prompts
Sentence chart review	Well done! You have created a 5 sentence paragraph: In this chapter, Ponyboy is a main character. I think Ponyboy is nice. I think he is nice because he looks out for his friends. Another reason I think Ponyboy is nice is that he made friends with the girls. In conclusion, I think that it is good that Ponyboy is nice.	Read aloud and review completed sentences and sentence types

were collected for a minimum of three sessions across participants. Once data were stable for the first participant, we introduced the intervention and collected data across the remaining story chapters. Once we observed a change in each participant, we introduced the intervention to the next participant and continued across the remaining chapters. We collected and graphed data on the percent of unprompted correct responses across baseline, intervention, and maintenance sessions.

Dependent Variables and Data Collection

The dependent variable was the percent of correct steps performed during students' opinion writing tasks. We scored steps as performed correctly if the student independently dragged a correct response in position to complete the sentence within 5 seconds. For topic and opinion statements, students were required to select one of two correct responses. For supporting facts and conclusion statements, students were required to select a single accurate response. During the baseline condition, the interventionist read each writing prompt and waited 5 seconds for a student response. A "+" was recorded for a correct response and a "-" was recorded for an incorrect or no response. During the intervention sessions, the interventionist scored the students' level of prompt needed to complete a response. An "I" was recorded for independent correct, "V" for verbal prompt, "M" for model prompt, and "P" for physical prompt.

To facilitate engagement during each session, the interventionist redirected the participant to look at the iPad and participate by turning the page. The level of engagement for each student was rated weekly using the following scale: 1) Does not participate at all (e.g., does not look at/in the direction of the iPad); 2) Passively participates (e.g., looks at the iPad or teacher as they respond, but makes no attempt to respond to teacher directions or iPad application directions without assistance); 3) Occasionally participates (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to less than half of the questions asked); 4)

Usually participates (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to at least 50% of the questions asked); 5) Actively participates most of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to more than 75% of the questions asked); and 6) Actively participates all of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to all questions asked).

Procedural fidelity and interobserver agreement (IOA). A second observer scored 33% of the baseline and intervention sessions using an implementation fidelity checklist. We calculated procedural fidelity by dividing the number of steps delivered correctly by the total number of procedural steps and multiplied by 100. Procedural fidelity for baseline and intervention sessions was 98% (94%-100%). A third researcher collected IOA data on 66% of procedural fidelity observations. We calculated IOA by dividing the numbers of agreements by the number of agreements and disagreements and multiplying by 100. IOA was 92% (range of 85-100%).

We also calculated IOA on the number of correct student response data for 29% of the baseline and intervention sessions. IOA was calculated by taking the number of agreements divided by the number of agreements plus disagreements and multiplying by 100. IOA for baseline and intervention sessions was 94% (range of 91-100%).

Social validity. At the end of the study, the researcher collected social validity data on the purpose, process, and outcome of the study from the classroom teacher. The special education teacher completed a social validity questionnaire with 16 Likert scale items and several open-ended questions. Likert scale items included questions such as: "Was the application successful in engaging the student?" "Were the picture icons helpful?" "Were learning parts of the paragraph a valuable activity?" and "I noticed time on task increased for other classroom activities." Open-ended questions were in alignment with the Likert-scale questions to allow

the teacher to expound on student observations. Teacher answers gave further insight to questions such as: “To what extent did your student show engagement?” “Were there too many or too few picture icons?” and “Do you like using your own system of least prompts and praise or would you prefer that to be built into the program?”

Procedures

Baseline. The interventionist and student sat side-by-side with the iPad placed between them. The students listened to a chapter pairing (in sequence) of the adapted text, *Outsiders* read by the *Access: Language Arts* app. After the read-aloud, the interventionist opened the writing activity in the *GoBook* app. *GoBook* presented the following series of spoken prompts: (a) What will you write about? (either a main character, big idea, or setting were presented as options); (b) Who/Where/What do you want to write about? (this varied depending on the topic chosen); (c) What is your opinion of ____? (filled in with specific who, what, or where identified from prior step); (d) Which fact supports your opinion? (e) Choose another fact that supports your opinion; and (f) What is your conclusion sentence? Three response options were presented with each prompt (e.g., I think Ponyboy was good because.... he was nice to Cherry; he was mean to Cherry; a bus). Between each of the above writing prompts, the student had an opportunity to drag and drop missing words from the sentence into the correct blanks. For example, the following sentence would appear “I think ____ was good because he was ____ to Cherry.” and the student would have to drag and drop the missing words (Ponyboy; nice) into the correct blank space. Students were given 5 seconds to initiate a response for filling in the blanks. If the student responded correctly to a writing prompt, the interventionist scored a “+” on a data collection sheet. If the student selected an incorrect response or did not respond within 5 seconds, the interventionist scored a “-”. Throughout baseline, prompting to promote a correct student response was not provided and reinforcement for a correct response or error correction for an

incorrect response was not provided. Students were praised for attending behaviors throughout baseline.

Intervention. At the onset of each intervention session, the student listened to a reading of the targeted chapters from *Outsiders* in the *Access: Language Arts* app. Once the read-aloud was finished, the interventionist introduced the writing activity in the *GoBook* app. First, the interventionist presented five targeted vocabulary words associated with the opinion paragraphs (i.e., sentence, paragraph, fact, introduction, conclusion). *GoBook* presented each word and read each definition aloud. Second, the interventionist presented the five-sentence paragraph structure (i.e., introduction, opinion, fact, fact, conclusion) using *GoBook* and a model, lead, test procedure (Larkin, 2001). The interventionist modeled a five-sentence paragraph using a graphic organizer within the app. The interventionist presented the sentence description (i.e., “The introduction is the first sentence in your paragraph. The introduction tells who, or what we are writing about.”) while touching the introduction button preprogrammed into the app. Then the interventionist and the student pressed the introduction button together. Finally, the student independently pressed the introduction button to state the rule. This instruction continued for the remaining parts of the paragraph. After instruction on the sentence type, the students applied their knowledge by creating their own five-sentence opinion paragraphs. *GoBook* presented the stimulus “What topic do you want to write about?” and presented three response options. If the student responded incorrectly, *GoBook* presented an error correction and an auditory prompt, “The (incorrect response) was not a part of our story.” The app then repeated the step, but with the incorrect response option highlighted in gray and inactive. This process was repeated until the student selected the correct response or was left with a single correct response. If the student did not respond within 5 seconds, the interventionist implemented a system of least prompts procedure. First, the interventionist presented a verbal prompt and waited 5 seconds for

the student to respond. If the student did not respond, the interventionist presented the next level of prompt in a predetermined hierarchy (i.e., verbal prompt, model prompt, physical prompt). After the student identified a topic, the next screen in the app presented an opportunity for the student to drag and drop their response to complete an introduction sentence (e.g., I want to write about _____). Their newly created sentence was placed into a graphic organizer in the “intro sentence” spot as the first sentence. This same process continued until the student identified all sentences in the five-sentence opinion paragraph (i.e., their opinion, two supporting facts from the story, and a matching conclusion). Students were presented with the same chapter pair for three consecutive sessions, but had an opportunity to write about a new topic and opinion each time. Subsequently, we presented a single baseline probe on the next chapter pair before entering intervention with that chapter pair. We conducted these probes to assess whether students had generalized their paragraph writing skills to untrained chapter content. We collected maintenance data approximately two weeks after the students finished the intervention. Maintenance probes were conducted using procedures identical to those in baseline conditions.

Results

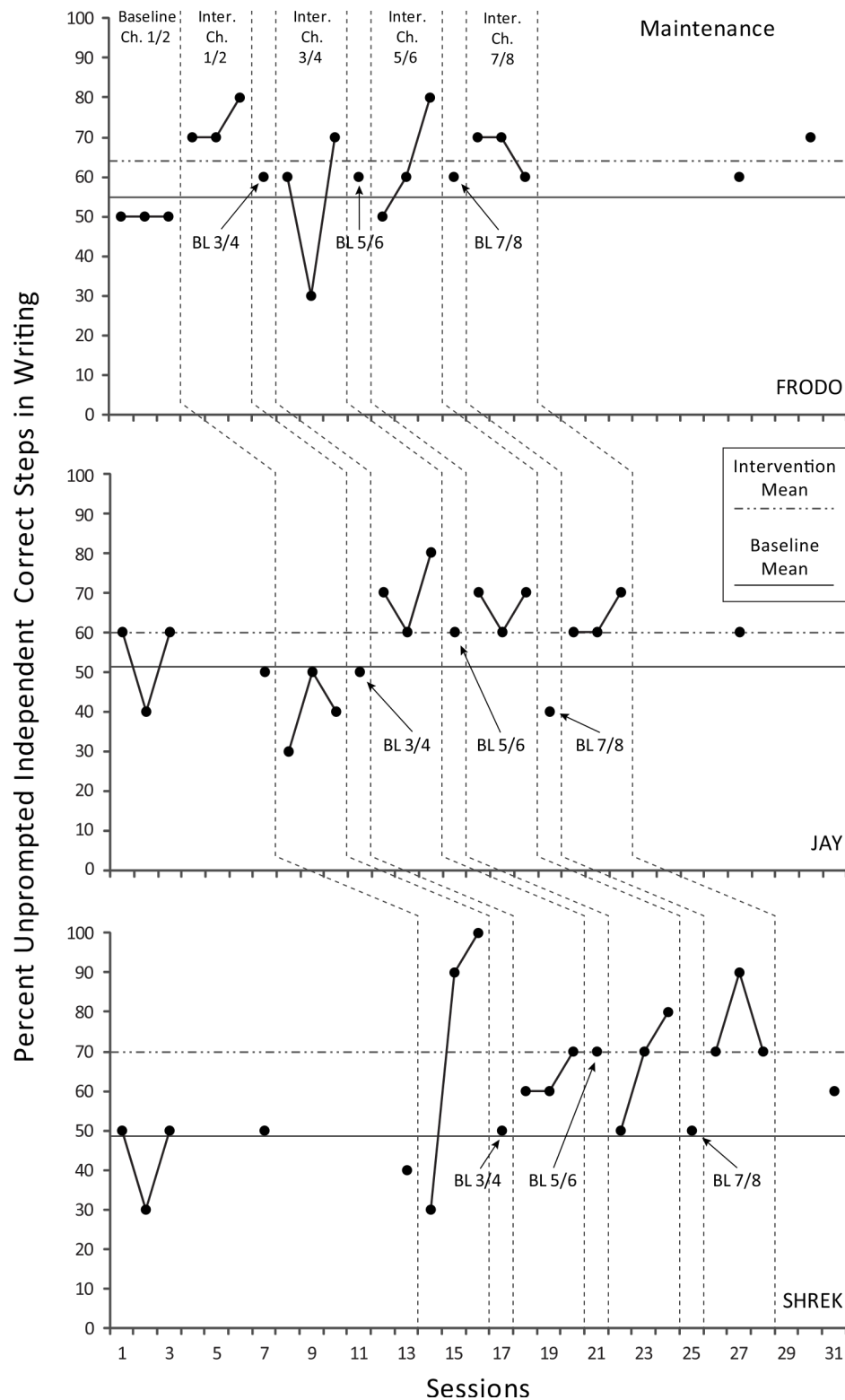
The percent of correct steps performed during students’ opinion writing tasks during baseline and intervention sessions are depicted in Figure 1. Frodo’s performance was stable during baseline sessions (i.e., 50% across all three probes). Following the introduction of intervention on Chapters 1 and 2, her performance improved to an average 73% of correct steps (i.e., 70, 70, 80%). Prior to intervention on Chapter 3 and 4, Frodo performed 60% of steps correctly. During intervention on Chapters 3 and 4, Frodo averaged correct performance of 53% of steps (i.e., 30, 60, 70). Prior to instruction, on Chapters 5 and 6, Frodo completed 60% of steps, whereas during instruction the average was 63% of completed steps (i.e., 50,

60, 80). Finally, prior to instruction in Chapters 7 and 8, Frodo completed 60% of steps. Following instruction, 67% of the steps (i.e., 60, 70, 70) were completed. At 4 and 5 weeks following intervention, Frodo completed 60% and 70% of steps, respectively. Overall, Frodo increased her mean performance from baseline to intervention conditions by 14% and regarding effect size, the percent of non-overlapping data (PND) were calculated at 86% (Scruggs & Mastropieri, 2001).

During baseline sessions, Jay completed an average of 52.5% of steps correctly (i.e., 60, 40, 60, 50). Following the introduction of intervention on Chapters 1 and 2, Jay averaged a 40% correct completion of steps (i.e., 30, 50, 40). Prior to intervention on Chapters 3 and 4, Jay completed 50% of steps correctly. During intervention on Chapters 3 and 4, Jay averaged correct completion of 70% of steps (i.e., 70, 60, 80). Prior to instruction, on Chapters 5 and 6, 60% of steps were completed correctly, whereas during instruction Jay completed an average of 73% of steps correctly (i.e., 70, 60, 70). Finally, prior to instruction in Chapters 7 and 8, Jay completed 40% of steps correctly. Following instruction, 63% of steps were completed correctly (i.e., 60, 60, 70). At 3 weeks following intervention, Jay completed 60% of steps correctly. Overall, Jay increased his mean performance from baseline to intervention conditions by 7.5% with a PND of 38%.

Shrek completed an average of 44% of steps correctly during baseline sessions (i.e., 50, 30, 50, 50, 40). During intervention on Chapters 1 and 2, Shrek averaged correct completion of 73% of steps (i.e., 30, 90, 100). Prior to intervention on Chapters 3 and 4, 50% of steps were completed correctly. During intervention on Chapters 3 and 4, Shrek averaged correct completion of 63% of steps (i.e., 60, 60, 70). Prior to instruction, on Chapters 5 and 6, 70% of steps were completed correctly, whereas during instruction an average of 67% of steps were completed correctly (i.e., 50, 70, 80). Finally, prior to instruction in Chapters 7 and 8, Shrek completed 50% of steps correctly. Following instruction, Shrek

Figure 1
Percent of unprompted correct steps in opinion writing process across the chapter pairs of an adapted version of *Outsiders*.



completed 77% of steps (i.e., 70, 90, 70) correctly. At 2 weeks following intervention, Shrek completed 60% of steps correctly. Overall, Shrek increased his mean performance from baseline to intervention conditions by 23.5% with a PND of 85%.

Social Validity

Overall, the teacher reported favorable perceptions of the study components. On the Likert scale, the teacher scored five items as “strongly agree” including (a) the app was engaging to the students, (b) the read aloud of *Outsiders* was appropriate for the students, (c) the picture icons were helpful through the stories, (d) assessing the student’s ability to correctly answer questions in a guided writing activity is valuable, and (e) the incorrect-answer pages (pages with corrective feedback) were useful in helping to re-direct students to make correct choices during their writing activity. The teacher scored 8 items as “agree.” These items included (a) learning the parts of a paragraph was valuable for her students to learn about writing, (b) students showed an increase in vocabulary after the implementation of the intervention, (c) time-on-task increased after the app was introduced to the student, (d) the intervention was important and appropriate, (e) due to the app, her students had better access, (f) due to the app, she was more effective in teaching age/grade appropriate ELA curriculum, (g) the teacher was interested in continuing the use of the writing activity in her classroom, and (h) the hint feature was helpful to the students. The teacher scored one item as “neutral;” (i.e., the ELA app was more relevant than what was previously implemented for ELA instruction).

In addition, we asked the teacher to complete an open-ended survey related to the instructional package. Overall, the teacher’s responses were positive. The teacher reported that students were increasingly more engaged as they became familiar with the app and activity. The teacher also suggested that the “right” number of picture supports were used in the read-aloud story and that she would prefer to continue using the app in the

classroom. The teacher reported that the average lesson was an appropriate length (25-45 min). However, the teacher indicated the app might be more suited for a 1:1 instructional arrangement and suggested that “the paragraph definitions, paragraph structure, and story is a lot for more than one student to stay engaged in as a group.” In addition, the teacher warned about careful selection of highly disparate distractors for future studies or implications for practice as she mentioned that some of these distractors were “fun responses and grabbed students’ attention.” The teacher offered several recommendations for the improvement of the writing intervention app including (a) incorporate more human-like voices, (b) embed additional positive feedback prompts within the program, (c) reduce the number of words per page, and (d) ensure that the distractor item did not include potentially reinforcing stimuli (i.e., food items).

Engagement

In addition to social validity, a weekly self-reported engagement rating was collected. While the engagement measure did not include a direct measure of daily baseline and intervention sessions, the interventionist self-reported high levels of engagement with an overall rating of 5.12 indicating that the students actively participated most of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to more than 75% of the questions asked). Frodo’s and Shrek’s average engagement scores were 4.75, (range=3–6) and 4.8 (range = 4-6), respectively. Jay showed very high engagement at 5.83, which indicated nearly 100% engagement through every session, with the exception of one session with a rating of 5.

Outcomes and Benefits

In the current investigation, the researchers demonstrated that students with moderate and severe intellectual disability could improve their skills in written expression, specifically opinion writing, when provided with appropriate assistive technology supports and explicit instruction. Participants

used features of the *GoBook* app to circumvent challenges often consistent with moderate and severe intellectual disability to produce a permanent product detailing their opinion about an adapted and grade-aligned fictional novel. For example, *GoBook* permitted students with limited spelling repertoires and fine motor impairments to construct narratives by dragging whole words from a choice array to complete sentences. Furthermore, the *GoBook* package incorporated a range of supports for emerging readers including story narration, integrated vocabulary instruction, and hints for supported word selection. These factors may have contributed to the overall, interventionist reported, high levels of engagement by the students while using *GoBook*.

It is also important to note that *GoBook* incorporated research-based prompting procedures that minimized the need for an adult interaction during instruction. The use of increasingly autonomous instructional software is critical for students with moderate and severe intellectual disability as it may increase the time that students are able to work without adult assistance, perhaps promoting the view that persons with moderate and severe intellectual disability can be active participants in their own learning. In addition, this investigation targeted the selection and supporting of students' opinions. Though in the current study, opinions were directly linked to a specific and limited context, it is important to note the instruction of expressing an opinion is consistent with principles of promoting self-determination for persons with moderate and severe intellectual disability.

Discussion

The purpose of this investigation was to evaluate the effectiveness of a technology-based instructional package on the writing skills of three participants with moderate and severe intellectual disability. Despite variability in performance across participants and instructional units (i.e., chapters), all participants improved their performance in writing tasks from baseline to intervention conditions

and in a relatively short period of time. Furthermore, they maintained levels of responding above those during baseline conditions. These findings are promising in that they suggest that students with moderate and severe intellectual disability can benefit from TAI that simultaneously targets skills in reading and written expression. Interestingly, only Frodo demonstrated an improvement from pretreatment baseline probes to probes conducted prior to introducing a new chapter pairing. An increase in student performance on these chapter probes might suggest the generalization of writing skills to novel content. This lack of generalization across participants may have been a result of exposure to an insufficient number of exemplars (e.g. different reading passages) and/or the limited duration of the study.

The current intervention package reflects a departure from the extant literature on writing instruction for students with moderate and severe intellectual disability but is consistent with the development of written expression in general education settings whereby students continuously apply a range of writing skills across multiple areas of academic content. Students in the current study were taught a cluster of writing skills including vocabulary usage, sentence completion, paragraph organization, and opinion writing in the context of grade appropriate text. This complexity may have contributed to the limited improvement across participants while obscuring progress across skills independent of each other.

Furthermore, this investigation served to pilot a new software application for teaching writing skills to students with moderate and severe intellectual disability. Several applications have been developed for supporting students with disabilities during writing activities. The majority of these programs provide students with accommodations (e.g., text to speech) or modifications (e.g., word banks) during the production of text. Unfortunately, there are few programs that embed explicit writing instruction targeted for this population. The *GoBook* app provided controlled presentation of instructional

stimuli, prompts, and feedback. These features are advantageous as they may result in fewer errors in instructional delivery and greater student independence from adult supervision during instruction.

Finally, the current study may serve to inform new innovations in the development of more comprehensive literacy software for students with moderate and severe intellectual disability. For example, teacher feedback and student performance indicate a need for the reduction of the amount of text displayed on each screen and an increased use of programmed positive feedback in order to encourage engagement. It is also important to note that the authors aligned instructional targets within the app to grade appropriate ELA standards. This feature may enhance the utility of the app, as teachers and peers without disabilities may find it easier to include students with moderate and severe intellectual disability in general education instruction. This alignment also poses new challenges for researchers and programmers in the development of TAI that is aligned from kindergarten to graduation.

Despite our overall positive findings, several limitations must be addressed. First, we conducted a single probe prior to the introduction of intervention for Jay and Shrek. Though these data were consistent with the patterns expressed in the first three baseline data points, it is plausible that these data may not have accurately reflected participants' steady level of responding. Second, we did not assess student's reading of the words and pictures used within the adapted text and app or the engagement with the underlined vocabulary words within the adapted text. Though all vocabulary was presented as text or pictures and in a digitized voice, variability in students reading repertoire may have impacted performance across chapters. Third, the amount of content (number of pages) programmed into the pilot *GoBook* app triggered instability, resulting in intermittent malfunctions in the software. These malfunctions required the student to wait while the program rebooted and potentially

affected students' motivation and their success with the intervention during that session. Across at least five sessions, the program shut down and required the interventionist to reset the app and page through the app until the student was back to the location where they had been working. Fourth, it is valuable to note that two of three students demonstrated an effective intervention based on PND while the third demonstrated an ineffective intervention PND (Scruggs & Mastropieri, 2001). However, it is also noted that there are concerns over the use of PNDs to measure effect size in single subject design (Olive & Franco, 2008) and overall the third student did have a 7.5% change in mean from baseline to intervention. Therefore, the results of this pilot study serve as a first step in regard to available supports for opinion writing for students with moderate and severe intellectual disability. A fifth limitation was the use of a nonstandardized social validity measure. Although it is common in single subject research to use a researcher-created measure, a standardized measure would have been stronger. Finally, the small number of participants limit the generalizability of findings. In contrast to these limitations, when considered with the literature base on opinion writing for students with moderate and severe intellectual disability, the current study adds to the overall evidence for using this method with this population.

In summary, we evaluated the efficacy of an innovative TAI package for improving written expression for students with moderate and severe intellectual disability. The current body of literature in this area provides little guidance for teaching students with moderate and severe intellectual disability to perform complex writing tasks. Even less guidance is available on how to embed those tasks into ongoing academic instruction. We sought to address these issues by developing an intervention package aligned with grade-level skills, compatible with ongoing instruction in the general education curriculum. We feel this study serves as a pilot study that can be used to guide other work in this area. The development of written communication is critical to the success of all students and has

vast implications across every aspect of one's life. Therefore, it is essential that researchers continue to investigate new and effective writing strategies that can be implemented in ways that reflect the ubiquitous nature of written expression in the natural world.

Declarations

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